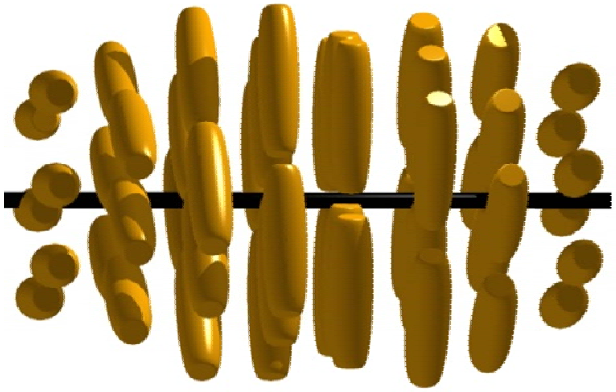
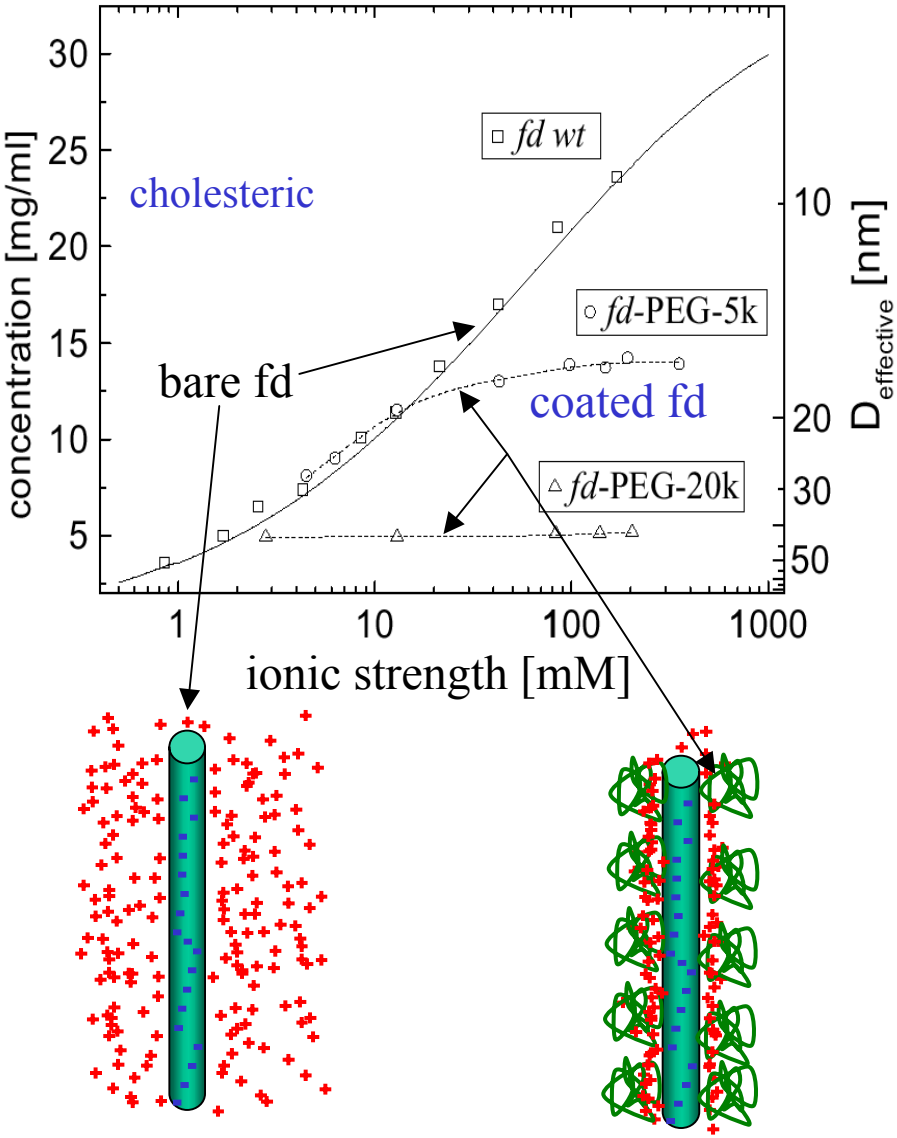


The Puzzling Role of Electrostatics in Chiral Liquid Crystals

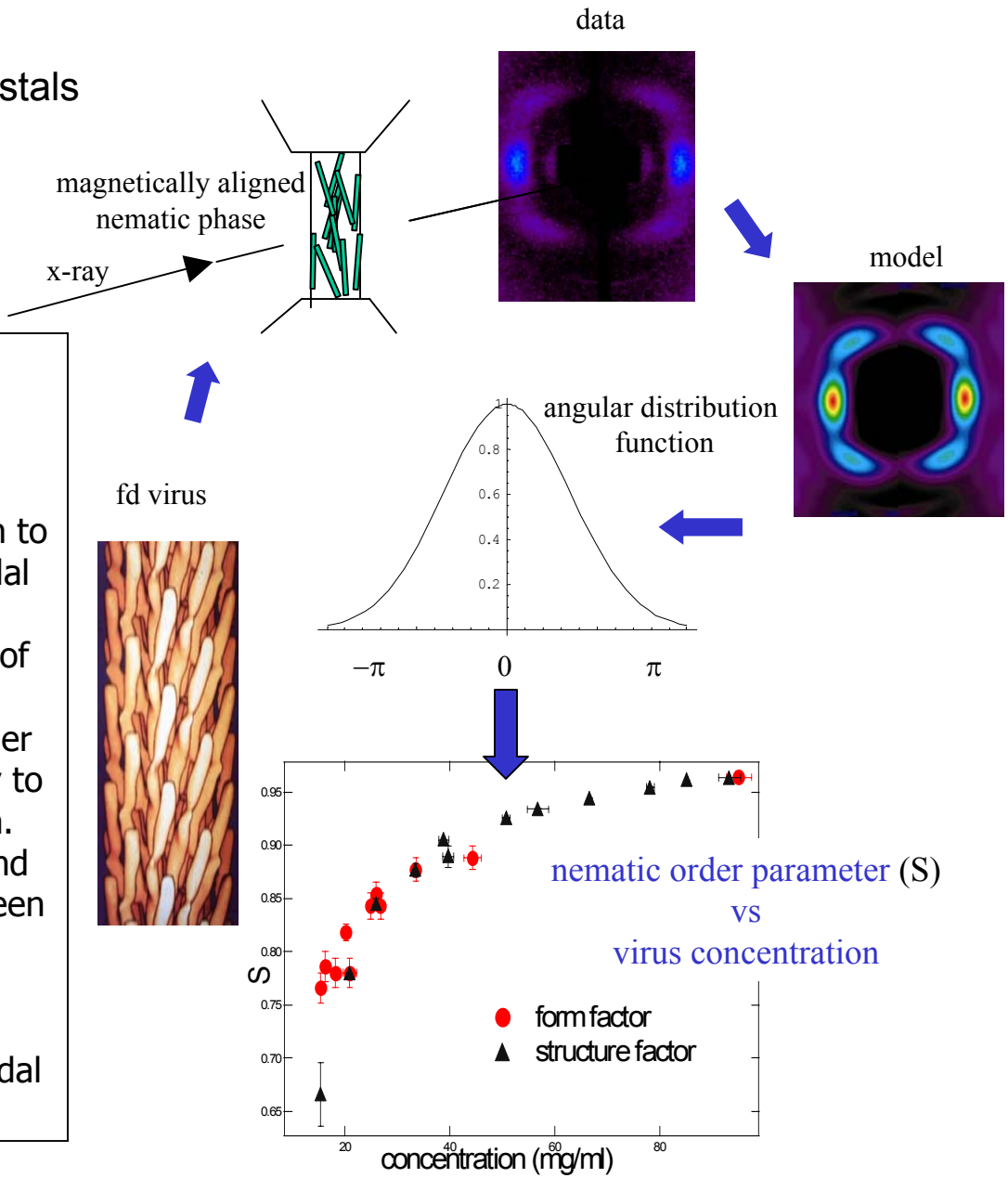
Seth Fraden, Brandeis University, DMR Award #0088008

The rodlike virus fd has an isotropic – cholesteric (I - C) phase transition whose virus concentration increases with ionic strength in quantitative accord with the Onsager theory for charged rods (bare fd). Grafting polymers (PEG) to rodlike viruses results in a sterically stabilized colloidal suspension of rods. In this case the I - C phase transition is independent of ionic strength and is theoretically explained with the Onsager model of hard rods, which means all two-body interactions are independent of electrostatics. Remarkably, the grafted virus still forms a cholesteric phase, implying that the chiral interactions propagate through the polymer, even though the polymer is more than twice the diameter of the virus. More surprisingly, the cholesteric pitch varies with ionic strength in spite of the fact that the co-existence concentrations and nematic order paramenter are independent of ionic strength. This implies that (1) electrostatics controls chirality, and (2) that the chiral forces responsible for the cholesteric phase are not two-body interactions.



Orientational Order in Colloidal Liquid Crystals

Seth Fraden, Brandeis University,
DMR Award #0088008



Brief summary of outreach activities:

Educational:

1 grad student: Kirstin Purdy (USA).

Ms. Purdy has used x-ray synchrotron radiation to study angular and spatial correlations in colloidal liquid crystals. She has measured the angular distribution function (ADF) in a nematic phase of monodisperse viruses. The ADF is the central quantity in Onsager's theory of nematics and her experiments constitute the most detailed study to date of this entropically driven phase transition. Her work has also demonstrated that spatial and angular correlations decouple. This has long been assumed to be true, but not proven till now.

1 post-doc: Eric Grelet (France).

Dr. Grelet has studied the influence of electrostatics on the cholesteric phase of colloidal liquid crystals described in the previous slide.